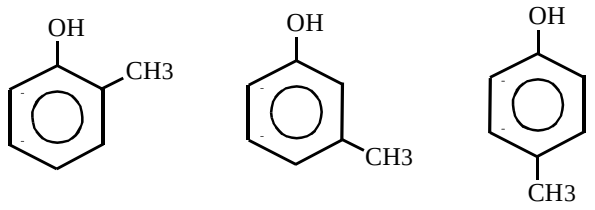
CRESOLS/CRESYLIC ACID
(Isomers and Mixtures)

Cresols/cresylic acid are federal hazardous air pollutants and were identified as toxic air contaminants in April 1993 under AB 2728.

CAS Registry Number (mixed): 1319-77-3

Molecular Formula: C_7H_8O



o-Cresol m-Cresol p-Cresol

This summary sheet refers to the mixture of o-cresol, m-cresol, and p-cresol. o-Cresol is a crystal or liquid, m-cresol is a colorless to yellowish liquid, and p-cresol is a crystal. The "mixed" cresols have a phenolic odor. The o- and m-cresol isomers are soluble in water, and in solutions of fixed alkali hydroxides, and are miscible with alcohol, chloroform, and ether. p-Cresol is soluble in organic solvents, and is volatile in steam. All isomers are flammable when exposed to heat or flame, and m- and p-cresol are moderately explosive when exposed to heat or flame (Merck, 1989; Sax, 1989).

Physical Properties of Cresols

Synonyms: o-Cresol: 2-hydroxytoluene, 2-methylphenol, o-cresylic acid, 2-cresol, orthocresol, o-hydroxytoluene, o-oxytoluene, o-toluol, o-methylphenol.

m-Cresol: 3-cresol; m-cresylic acid; 1-hydroxy-3-methylbenzene; m-toluol; m-hydroxytoluene; m-methylphenol; 3-methylphenol; m-oxytoluene; 3-hydroxytoluene.

p-Cresol: 4-cresol, p-cresylic acid, p-toluol, p-toluol alcohol, p-hydroxytoluene, 1-hydroxy-4-methylbenzene, 4-hydroxytoluene, paramethyl phenol, p-methylphenol, 4-methylphenol, p-oxytoluene.

	o-Cresol	m-Cresol	p-Cresol
CAS Registry Number	95-48-7	108-39-4	106-44-5
Molecular Weight:	108.14	108.14	108.14
Boiling Point:	190.95 °C	202.8 °C	201.9 °C
Melting Point:	30.90 °C	11 - 12.0 °C	34.8 °C

Physical Properties of Cresols (continued)

Flash Point:	178.0 °F	202.0 °F	202.0 °F
Vapor Density:	3.72	3.72	3.72 (air = 1)
Density at 20 °C:	1.047	1.034	1.0341
Vapor Pressure at 25 °C:	0.299 mm Hg	0.138 mm Hg	0.11 mm Hg
Log Octanol/Water Partition Coefficient:	1.95	1.96	1.94
Conversion Factor:	1 ppm = 4.42 mg/m^3 for all 3 isomers		

(HSDB, 1991; Merck, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

The m-cresol isomer is used in photographic developing, polyester solvents, disinfectants, and fumigants. m-Cresol has been detected in emissions from coal tar refining, explosive use, wood pulping, metal refining, and incineration of fruits and vegetables. It has also been detected in tobacco smoke, motor vehicle exhaust, and the pyrolysis of some epoxy resins. m-Cresol is also a photo-oxidation product of toluene (Howard, 1990).

The o-cresol isomer is used in plastics and resins manufacturing and in solvents. o-Cresol has been detected in motor vehicle exhaust, tobacco smoke and emissions from wood pulping, coal tar and petroleum refining, and ore floatation and textile scouring operations. It is also a photo-oxidation product of toluene (Howard, 1990).

The p-cresol isomer has been detected in emissions from coal tar and metal refining, chemical and glass fiber manufacturing, motor vehicle exhaust, wood pulping, brewing, and tobacco smoke. It is also the photo-oxidation product of toluene (Howard, 1990).

The primary stationary sources that have reported emissions of mixed cresols in California are petroleum refining, miscellaneous wood product manufacturing, and airports, flying fields and services (ARB, 1997b).

m-Cresol is registered as a fungicide for the control of bacteria and fungi on a variety of ornamental plants, on nut trees, on certain stone fruits, grapes and olives (DPR 1996). Cresylic acid was registered for use as a pesticide; however as of 12/31/91, it is no longer registered for pesticidal use in California (DPR, 1997). The licensing and regulation of pesticides for sale and use in California is the responsibility of the Department of Pesticide Regulation (DPR). Information presented in this fact sheet regarding the permitted pesticidal uses of m-cresol has been collected from pesticide labels registered for use in California and from DPR's pesticide databases. This information reflects pesticide use and permitted uses in California as of October 15, 1996. For further information regarding the pesticidal uses of this compound, please

contact the Pesticide Registration Branch of DPR (DPR, 1996).

B. Emissions

The total emissions of mixed cresols from stationary sources in California are estimated to be at least 12,000 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Mixed cresols are found to naturally occur in coal, petroleum, and wood (HSDB, 1991).

AMBIENT CONCENTRATIONS

No Air Resources Board ambient air data exist for cresols. However, the United States Environmental Protection Agency (U.S. EPA) has compiled 1982 ambient air data in two United States urban locations for m-cresol, 1984 ambient air data in Portland, Oregon for o-cresol, and 1985 ambient air data in 11 urban California sites for p-cresol, with reported mean concentrations of 1.4, 0.07, and 4.6 micrograms per cubic meter ($\mu g/m^3$) or 0.32, 0.02, and 1.04 parts per billion, respectively (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

Indoor sources of cresol include combustion sources such as environmental tobacco smoke (ETS) and wood smoke, as well as consumer products such as paint brush cleaners, paint removers, household sanitizers, fumigants, and insecticides/miticides for dogs (Hodgson and Wooley, 1991).

Emission rates of m,p-cresol in environmental tobacco smoke from popular California cigarette brands measured in a test chamber averaged 83 μg/cigarette (Daisey et al., 1994). In the same study, the emission rates of o-cresol in ETS averaged 35 μg/cigarette.

ATMOSPHERIC PERSISTENCE

o-, m-, and p-Cresol exist in the atmosphere in the gas phase, and are formed from the hydroxyl (OH) radical-initiated reaction of toluene. The dominant atmospheric loss processes for the cresols are by daytime reaction with the OH radical and nighttime reaction with the NO_3 radical. The calculated half-life and lifetime of cresols due to reaction with the OH radical are 4 to 6 hours and 5 to 8 hours, respectively. The products of the OH radical and NO_3 radical reactions include nitrocresols (Atkinson, 1994). Cresols also undergo wet deposition, but this process is expected to be a minor overall loss process from the atmosphere because of the short

chemical half-life and lifetime of the cresols (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program (AB 2588). Of the risk assessments reviewed as of December 1996, for non-cancer effects, cresols contributed to a total hazard index greater than 1 in 1 of the 89 risk assessments reporting a total chronic hazard index greater than 1 (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to mixed cresols are inhalation, ingestion, and dermal contact.

Non-Cancer: Cresol is well absorbed by all routes. It is a central nervous system depressant, corrosive to the skin and eyes, and may induce methemoglobinemia. Acute inhalation exposure of humans to mixed cresols results in respiratory tract irritation with symptoms including dryness, nasal constriction, and throat irritation. No information is available on the chronic effects of inhalation exposure of humans to mixed cresols. Oral exposure in animals has been reported to result in effects on the blood, liver, kidney, central nervous system, and reduced body weight (U.S. EPA, 1994a).

A chronic non-cancer Reference Exposure Level (REL) of 1.8×10^2 $\mu g/m^3$ is listed for m-cresol, o-cresol, and p-cresol in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the central and peripheral nervous systems (CAPCOA, 1993).

The U.S. EPA has concluded that data are inadequate for the establishment of a Reference Concentration (RfC) for mixed cresols, o-cresol, m-cresol, or p-cresol, and has the oral Reference Dose (RfD) for mixed cresols under review. The U.S. EPA has set an oral RfD for o-cresol and m-cresol of 0.05 milligrams per kilogram per day (mg/kg/d) based on decreased body weights and neurotoxicity in rats, with the provisional RfD for p-cresol set at 0.005 mg/kg/d. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not likely result in the occurrence of chronic non-cancer effects (U.S. EPA, 1994a).

No information is available on adverse reproductive or developmental effects of mixed cresols in humans. Results from animal studies have indicated developmental effects, but only at maternally toxic doses, with no reproductive effects from oral exposure to mixed cresols (U.S. EPA, 1994a).

Cancer: Only anecdotal information is available on the carcinogenic effects of mixed cresols in humans. Results from a 13-week oral study, the only available animal study, suggested that p-cresol may act as a promotor for forestomach tumors. Results from several dermal studies indicate that o-cresol, m-cresol, and p-cresol may act as tumor promoters. The U.S. EPA has classified o-cresol, m-cresol, and p-cresol as Group C: Possible human carcinogens (U.S. EPA, 1994a). The International Agency for Research on Cancer has not classified the cresols for human carcinogenicity (IARC, 1987a).